

## **BMP #129 - Gabions**

### **DESCRIPTION**

Rectangular wire-mesh cages that are filled with rock and wired together to form a protective but permeable structure for slope stabilization and erosion control .

### **APPLICATIONS**

Gabions can be used as retaining walls to mechanically stabilize steep slopes, or for revetments, weirs, channel linings, culvert headwalls, and culvert outlet aprons. They are particularly useful where seepage is anticipated. For related information, refer to BMP #128 (Retaining walls).

### **LIMITATIONS**

Materials costs and professional design requirements may make use of gabions impractical. Gabions may alter stream dynamics or adversely affect wildlife habitat. When used in channels with high sediment loads, the galvanizing wire on the cages quickly wears off, causing rusting and the premature failure of the cages.

### **DESIGN PARAMETERS**

- Construction plans and specifications should be prepared by professionals familiar with the use of gabions. The structure must be able to handle expected storm and flood conditions.
- On streambank applications, the foundation is an important design feature of the structure. Consider the potential for the stream to erode the sides and bottom of the channel and make sure the gabions will be supported properly.
- The gabion structure must be securely "keyed" into the foundation and abutment surfaces. The rock filling holds the gabions in place by gravity, but tie-backs may be used if conditions warrant additional structural strength.
- Gabions are usually placed on a filter blanket (gravel layer of filter cloth) or both.

### **Materials**

#### **Targeted Pollutants**

- ☒ Sediment
- ☐ Phosphorus
- ☐ Trace metals
- ☐ Bacteria
- ☐ Petroleum hydrocarbons

#### **Physical Limits**

Drainage area unlimited

Max slope 40%

Min bedrock depth N/A

Min water table 2 ft

SCS soil type ABCD

Freeze/Thaw good

Drainage/Flood control no

Gabions should be fabricated in such a manner that the sides, ends, lids, and diaphragms can be assembled at the construction site into a rectangular basket of required sizes. Gabions should be of single unit construction -- the base, ends, and sides should either be woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that strength and flexibility at the point of connection is at least equal to that of the mesh.

Where the length of the gabion exceeds its horizontal width, the gabion should be equally divided by diaphragms, of the same mesh and gage as the body of the gabions, into cells whose length does not exceed the horizontal width. The gabion should be furnished with the necessary diaphragms secured in proper position on the base section in such a manner that no additional tying at this juncture will be necessary.

All perimeter edges should be securely selvaged or bound so that the joints formed by tying the selvages have the same strength as the body of the mesh.

The fill material for the wire gabions should be rock ranging in size from a minimum of 4 inches (100 mm) to a maximum of 8 inches (200 mm), both measured in the greatest dimension. Rock should be sound, durable, well graded, and should be obtained from a source approved by the Engineer.

See the ITD Catalog of Best Management Practices (July 1994) for additional detailed design criteria for gabions.

## **CONSTRUCTION GUIDELINES**

Empty gabion baskets should be placed on a smooth, firm foundation excavated as directed by the plans. Each row, tier, or layer of baskets should be reasonably straight and should conform to the line and grade shown on the plans or established by the Project Engineer. The empty gabion baskets should be fastened to the adjacent baskets along the top and vertical edges. Each layer should be fastened to the underlying layer along the front, back and ends. Fastening should be performed in the same manner as provided for assembling the gabion units.

Unless otherwise indicated on the plans, the vertical joints between basket units of adjacent tiers or layers, along the length of the structure, should be staggered by at least one cell.

Before filling each gabion with rock, all kinks and folds in the wire mesh should be removed and all baskets should be properly aligned. A standard fence stretcher, chain fall or steel rod may be used to stretch the wire baskets and hold alignment.

The gabion cells should be carefully filled with rock placed by hand/machine in such a manner that the alignment of the structure will be maintained and so as to avoid bulges and to minimize voids. All exposed rock surface should have a reasonably smooth and neat appearance. No sharp rock edges should project through the wire mesh.

The gabion cells in any row or layer should be filled in stages so that local deformations may be avoided. At no time should any cell be filled to a depth exceeding 12 inches (305 mm) more than any adjacent cell.

The layer of rock should completely fill the gabion basket so that the lid will bear on the rock when it is secured. The lid should be joined to the sides, ends, and diaphragms in the same manner as specified for joining the vertical edges. The gabion basket lid should be secured so that no more than 1 inch (25 mm) gap remains at any connection.

Gabion rows or layers not completed at the end of each shift should have the last gabion filled with rock tied internally as an end gabion.

The area behind the gabion structure should be backfilled with granular material. Geotextile, if required, should be spread uniformly over the back of the gabion structure as shown on the plans. Joining edges of the geotextile should be overlapped a minimum of 12 inches (305 mm) and should be anchored in position with approved anchoring devices. The Contractor should place the backfill material in a manner that will not tear, puncture, or shift the geotextile.

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## **MAINTENANCE**

Inspect regularly and after each major storm. Check for signs of undercutting or other instability. Repair damaged areas immediately to restore designed effectiveness and to prevent damage or erosion of the slope or streambank.

Check wire of cages for rusting and wear. Repair where possible or replace.